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(54) **NATURAL COCOA ALTERNATIVE**
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(56) References cited:
WO-A2-2015/023935 US-A- 3 663 718
US-A- 5 676 993 US-A1- 2008 213 412
US-A1- 2013 156 893 US-A1- 2015 366 248

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Description**TECHNICAL FIELD**

5 **[0001]** The present disclosure is directed towards a cocoa replacer/alternative/substitute or cocoa enhancer that can be used in a wide range of food products.

BACKGROUND

10 **[0002]** Cocoa is a high demand, relatively expensive ingredient used in a wide range of food products.

[0003] The benefits of cocoa and products made from cocoa are numerous. For example, studies suggest that dark chocolate can reduce the risk of cardiovascular disease. Moreover, unsweetened cocoa is relatively low in calories, and contains essential minerals that support heart, bone, and immune system health.

15 **[0004]** The taste of cocoa is also cherished worldwide and is the basis for drinks and confectionary products of all levels of quality and variety of taste profiles.

[0005] Cocoa is derived from the beans of the cacao plant. Typically, the beans are cold pressed and the fats ("butter") pressed out of the beans, yielding powdered cacao, which still contains "living" enzymes from the beans. Cocoa is the roasted (usually at high heat) cacao powder, which deactivates the enzymes. The butter is then added back into the cocoa to produce chocolate (usually with the addition of sugar and other ingredients to enhance flavor and mouthfeel (sensory attributes). There are a wide variety of cocoa flavors, depending on, e.g., the type of cacao beans and the region they are grown, the amount of sugar present, the amount of free amino acids present, and the cocoa color pigments.

20 **[0006]** There is also a variety of synthetic chocolate flavors that can contain many different synthetic (organic) compounds. Some examples of materials that can be blended to create the artificial tastes and smells of cocoa include butyraldehyde, cocoa hexenal, cocoa pentenal, cocoa resinoid, dimethyl pyrazine, butyl cinnamate, butyl-3,5-(and 25 3,6)-dimethyl pyrazine and other compounds.

[0007] In addition, cocoa pricing can be volatile and the industry can experience tight supplies as emerging markets are increasing their consumption of chocolate and cocoa-based products.

[0008] The food industry would welcome a way to both reduce and/or replace the usage of cocoa or chocolate in a range of food products with a natural (i.e., non- synthetic) alternative to cocoa.

30 **[0009]** US 2015/366248 A1 and US 2013/156893 A1 disclose methods for making a banana or plantain product comprising providing at least one unpeeled banana or plantain comprising banana or plantain peel and banana or plantain pulp, subjecting the unpeeled banana or plantain to a heat treatment at a temperature and for a time sufficient to gelatinize starch present in the unpeeled banana or plantain to form heat treated unpeeled banana or plantain, and comminuting the heat treated unpeeled banana or plantain to form a banana or plantain puree.

35 **[0010]** US 3 663 718 A discloses a chocolate flavored banana powder prepared by co-drying a mixture of banana puree, cocoa and optionally sugar, which is less hygroscopic than the original banana solids.

SUMMARY

40 **[0011]** In general terms, the present disclosure is directed to an all-natural cocoa substitute made from green banana flour or plantain. In a given food product that ordinarily contains cocoa, a cocoa substitute of the present disclosure can be used to replace at least a substantial portion and/or enhance the cocoa. In a given food product that ordinarily contains cocoa, a cocoa substitute of the present disclosure can replace at least a substantial portion of the cocoa in the product.

45 **[0012]** More specifically, the present invention relates to compositions having the features disclosed in the following independent claim 1. Preferred features of the compositions of the present invention are disclosed in the dependent claims.

[0013] According to certain aspects of the present disclosure, not part of the present invention, a cocoa substitute is prepared by dry heating (e.g., roasting) green banana flour and/or plantain flour at a predefined temperature for a predefined time. The roasted flour can then be added to a food product to replace and/or enhance cocoa.

50 **[0014]** According to certain aspects of the present disclosure, an edible composition is provided comprising cocoa powder and roasted flour made from green banana and/or plantain, the cocoa powder and the roasted flour having a combined total mass, the roasted flour having a mass from 5% to 90% of the combined total mass.

55 **[0015]** According to certain aspects of the present disclosure, a cocoa replacer and/or enhancer produced by a method of the present disclosure substantially shares at least one and up to six or more sensory attributes in common with cocoa. In some examples, a food product made with a cocoa replacer and/or enhancer produced by a method of the present disclosure substantially shares at least one and up to six or more sensory attributes in common with a reference food product containing the same formulation as the food product, except wherein in the reference food product cocoa is substituted for the cocoa replacer and/or enhancer. Such sensory attributes can include, for examples, a chocolate

odor/aroma, a chocolate flavor, chocolate viscosity, bitterness, a toasted odor/aroma, a toasted flavor, a brown color resembling cocoa or chocolate, sweetness, and/or a melting quality.

[0016] In accordance with certain examples of the cocoa alternatives of the present disclosure, the bananas used to make the cocoa alternative are in Stage 1 or Stage 2 of ripeness. In other examples, the bananas used contain less than 1% sugar content.

[0017] As mentioned, cocoa and chocolate have a known sensory profile that gives the products certain attributes that identify the products as cocoa or chocolate. Thus, in accordance with certain aspects of the present disclosure, a cocoa replacer and/or enhancer has a sensory profile that is within a range of cocoa or chocolate sensory profiles, and/or within a predetermined deviation from a cocoa or chocolate sensory profile, e.g., within a range of +/- 50%, +/- 30%, or +/- 10% of a cocoa or chocolate sensory profile.

[0018] In addition, food products made with the roasted green banana flour and/or plantain flour in accordance with the present disclosure can share texture profiles, at least within a predetermined deviation, with reference products having the same formulation except wherein cocoa is substituted for the roasted green banana/plantain flour.

[0019] Thus, it has been discovered that roasted green banana flour and roasted plantain flour can provide an economical alternative to cocoa or chocolate with similar sensory attributes. When roasting green banana flour/plantain flour in specific conditions, it has been discovered that the material can develop a cocoa-like flavor, aroma, and color. Thus, in accordance with the present disclosure, roasted green banana flour/plantain flour has the possibility to at least partially replace cocoa or chocolate in many food applications.

BRIEF DESCRIPTION OF THE DRAWING

[0020] The Figure is a flow chart showing an example method of preparing roasted green banana flour in accordance with the present disclosure.

DETAILED DESCRIPTION

[0021] The present invention discloses a composition for a cocoa alternative comprising a flour selected from the group consisting of a gelatinized green banana flour that has been roasted, a gelatinized plantain flour that has been roasted, and combinations thereof and said composition comprising no cocoa, no cacao, and no derivative of cocoa or cacao.

[0022] Seven stages have been described in the ripening of the banana. Stage 1 is when the banana is completely green and has no signs of yellow on the skin. Stage 2 starts to show some slight signs of yellow usually at the distal end (the end farthest from the banana's point of attachment to the tree) of the banana. At the next three stages, the yellow continues from the distal end towards the proximal end of the fruit. At stage 6 of the ripening the banana is completely yellow. Stage 7 is when the banana starts to develop brown spots and finally turns completely brown.

[0023] As a banana ripens, the starch in its pulp converts to sugar. Thus, the starch present in the banana is being converted to sugars and the flavor changes from an earthy mild taste to the banana (isoamyl acetate) taste one normally associates with ripe bananas. During the ripening process, the granular starch found in green bananas is being converted to soluble starches and further to sugars.

[0024] Thus, for a given banana, each ripening stage can be correlated with its sugar content, which is defined herein as the percentage mass of sugars (sucrose, glucose, fructose) of the total mass of that banana's pulp. For purposes of this disclosure: a Stage 1 banana has a sugar content of 2% or less; a Stage 2 banana has a sugar content greater than 2% up to and including 5%; a Stage 3 banana has a sugar content greater than 5% up to and including 10%; a Stage 4 banana has a sugar content greater than 10% up to and including 25%; a Stage 5 banana has a sugar content greater than 25% up to and including 45%; a Stage 6 banana has a sugar content greater than 45% up to and including 65%; and a Stage 7 banana has a sugar content greater than 65%.

[0025] As used herein, and unless otherwise noted, the term "green banana" encompasses bananas that are in any of ripeness Stages 1, 2, 3, or 4 as defined herein. The term "green banana" further encompasses plantains having sugar content corresponding to that of any of ripeness Stages 1, 2, 3, and 4 defined herein, as plantains are very similar in composition of starch and proteins to green bananas.

[0026] As used herein, the term "slurry" refers to the material from peeled mashed green bananas.

[0027] Green banana flour is the resultant product of drying green banana slurry. Generally, green banana flour is generated by drying green banana slurry at a relatively low temperature so as to minimize disruption of the structure of the starch and protein native to the green banana.

[0028] Native green banana flour is a type of green banana flour in which the starch is in the native granular form. That is, the starch has not been physically or chemically modified.

[0029] Already gelatinized (or pre-gelatinized) green banana flour is another type of green banana flour in which the native granular structure of the starch has been partially or completely destroyed in the flour. Some example methods

for preparing a pre-gelatinized green banana flour include, but are not limited to, drum drying, spray drying or cooking native green banana flour, followed by precipitation, sonification, or the like.

[0030] As used herein, the term "green banana flour" encompasses both native green banana flour and pre-gelatinized green banana flour, unless otherwise noted.

[0031] By processing green banana flour with the application of direct and/or indirect heat (e.g. heat from radiant, microwave, solar, and/or convection sources), it has been found that the existing chemical compounds found within the green banana flour can be changed.

[0032] Under certain conditions, roasting (i.e., dry heating via one or more direct and/or indirect heating sources) green banana flour changes the flavor and/or aroma notes of the flour such that sensory attributes of chocolate or cocoa can be recognized. This roasted green banana flour, acting as a cocoa/chocolate alternative, can be used in a range of food applications. Examples of such food applications include, but are not limited to, baked goods, pancake mix, cookie mix, smoothies, puddings, dry seasonings, fruit fillings, cereal bars, baby-food, confectionary additive, energy bars, nutritional bars, and many other foods that ordinarily contain cocoa.

[0033] In at least some examples of the cocoa alternatives of the present disclosure, roasting of pre-gelatinized green banana flour can result in a cocoa alternative that more closely resembles real cocoa than does roasting of native green banana flour. Without being bound by any particular theory, it is believed that the starch chains of pre-gelatinized green banana flour are more readily rearranged by the roasting process into the compounds that adopt cocoa-like attributes than are the starch chains of native green banana flour. For example, the roasting process produces complex sugars, which are at least partially responsible for the sensory (taste, smell and texture) attributes associated with such roasted products. In some examples, such sugars may be more readily achieved from roasting pre-gelatinized green banana flour than native green banana flour.

[0034] Cocoa is a complex material with a variety of sensory attributes (flavors and smells) depending on where it was grown and how it was processed (e.g., roasted). Some examples of taste attributes associated with cocoa may include, e.g.: alkali, aromatic, astringent, bitter, chocolate, cocoa, fruity, roasted, sour, baggy, burnt and earthy. Some examples of aroma attributes associated with cocoa may include, e.g., pungent, cocoa, musty, malty, bready, sweet, chocolate, vanilla and bitter.

[0035] It has been discovered that a variety of these attributes can be obtained from the roasted green banana flour (either native or pre-gelatinized) of the present disclosure.

[0036] Thus, according to some examples, roasted green banana flour in accordance with the present disclosure will have at least one of the sensory attributes associated with cocoa. According to other examples, roasted green banana flour in accordance with the present disclosure will have at least two of the sensory attributes associated with cocoa. According to other examples, roasted green banana flour in accordance with the present disclosure will have at least three of the sensory attributes associated with cocoa. According to other examples, roasted green banana flour in accordance with the present disclosure will have four or more of the sensory attributes associated with cocoa.

[0037] In some examples, roasted green banana flour of the present disclosure includes only roasted native green banana flour. In some examples, roasted green banana flour of the present disclosure includes only roasted pre-gelatinized green banana flour. In some examples, roasted green banana flour of the present disclosure includes both roasted pre-gelatinized green banana flour and roasted native green banana flour.

[0038] In some examples, roasted green banana flour of the present disclosure includes green banana flour made from one or more of: plantains, green bananas in Stage 1 of ripeness, green bananas in Stage 2 of ripeness, green bananas in Stage 3 of ripeness, and/or green bananas in Stage 4 of ripeness. In particular examples, roasted green banana flour of the present disclosure includes green banana made only from one or more of: plantains, green bananas in Stage 1 of ripeness, and/or green bananas in Stage 2 of ripeness.

[0039] Referring now to the Figure, in an example process 100 of preparing roasted green banana flour, in an optional step 102 green banana flour is evenly distributed on a substantially flat surface, such as a tray, such that grouping or clumping of the green banana flour are minimized, and such that a substantially uniform layer of the green banana flour is formed on the surface. In some examples, a non-stick material, such as a parchment paper, can line the flat surface to minimize sticking of the green banana flour to the surface.

[0040] In a subsequent step 104 the green banana flour is roasted for a predefined time at a predefined temperature.

[0041] In an optional subsequent step 106, the green banana flour is redistributed on the flat surface such that grouping and clumping of the green banana flour are minimized, and such that a substantially uniform layer of the green banana flour is formed on the surface.

[0042] In an optional subsequent step 108, the green banana flour is roasted for a predefined time.

[0043] In an optional subsequent step 110, the steps 106 and 108 are repeated in sequence one, two, three, or more times, although the predefined time and/or temperature for each roasting may vary.

[0044] In an optional subsequent step 112, the roasted green banana flour is cooled, e.g., by placing a tray holding the roasted green banana flour on a wire rack.

[0045] In an optional step 114, the cooled (or not cooled) roasted green banana flour is packaged, e.g., in a hermetically

sealed package or added to a food product as a cocoa alternative.

[0046] In an optional step 116, the roasted green banana flour is added to a food product as a cocoa alternative.

[0047] The roasting step(s) of the process 100 can be facilitated by any appropriate heat source, e.g., a convection oven. The roasting steps can include one or more of air roasting, fluidized bed roasting, drum roasting, oven roasting, rotary tray roasting and/or coffee roasting.

[0048] In some examples, the predefined temperature of each of one or more of the roasting(s) in the process 100 is in a range from 160 °C to 220 °C. In some examples, the predefined temperature of one or more of the roasting(s) in the process 100 is in a range from 170 °C to 205 °C. In some examples, the predefined temperature of one or more of the roasting(s) in the process 100 is in a range from 190 °C to 205 °C. In some examples, the predefined temperature of one or more of the roasting(s) in the process 100 is in a range from 176 °C to 177 °C.

[0049] Variations in the example temperatures and times can vary from those described herein, such as variations of up to +/- 10 percent, or up to +/- 20 percent. Additionally, the times and temperatures can be different depending on the volume of green banana flour being processed.

[0050] It should also be appreciated that the use of different roasting temperatures and/or combinations of roasting temperatures can result in different cocoa-like sensory attribute profiles of the final roasted green banana flour. In at least some examples, the roasting temperature(s) is/are selected to minimize burnt flavors or aromas in the final roasted green banana flour.

[0051] In some examples, the predefined heating time of each of one or more of the roasting(s) in the process 100 is in a range from 10 minutes to 60 minutes. In some examples, the predefined heating time of each of one or more of the roasting(s) in the process 100 is in a range from 15 minutes to 45 minutes. In some examples, the predefined heating time of each of one or more of the roasting(s) in the process 100 is in a range from 15 minutes to 30 minutes. In some examples, the total combined roasting time from all the roasting steps of the process 100 is in a range from 10 minutes to 120 minutes. In some examples, the total combined roasting time from all the roasting steps of the process 100 is in a range from 10 minutes to 60 minutes. In some examples, the total combined roasting time from all the roasting steps of the process 100 is in a range from 15 minutes to 45 minutes. In some examples, the total combined roasting time from all the roasting steps of the process 100 is in a range from 15 minutes to 30 minutes. In some examples, the process 100 includes two, three, or four of the roasting steps, each of the roasting steps being in a range from 176 °C to 177 °C for 15 minutes or approximately 15 minutes.

[0052] In some examples, between roasting steps of the process 100, the green banana flour is allowed to cool by a predefined amount.

[0053] The process 100 can include one, two, three, four, five, six or more of the roasting steps, optionally with a redistribution of the green banana flour and/or cooling of the green banana flour between some or all of the roasting steps.

[0054] The roasted green banana flour produced by the process 100 can be used as an all-natural cocoa or chocolate alternative in a variety of foods and can have one or more of the following properties: all-natural, clean label, vegetarian, vegan, kosher, halal, gluten free, conventional or organic, containing fiber material and/or resistant starch, non-GMO, having chocolate flavor and notes but contains no chocolate, and allow for reduction or replacement of real chocolate or cocoa in a range of applications. The roasted green banana flour produced by the process 100 can provide viscosity enhancements, and/or nutritional enhancements to a food product, such as potassium, magnesium and manganese. In addition, the roasted green banana flour produced by the process 100 can be made from 100% fruit.

[0055] Cocoa and chocolate have known sensory attributes. These attributes are sometimes defined as including, for example, appearance, odor/aroma, flavor, texture, and global quality. In some examples, the roasted green banana flour produced by the process 100 shares at least one, two or more of the sensory attributes of cocoa or chocolate, such as: a chocolate smell, a chocolate flavor, bitterness, a toasted smell, a toasted flavor, a brown color, and/or sweetness.

FOOD PRODUCT EXAMPLES:

[0056] Described below are three example food products prepared with cocoa and/or roasted green banana flour, as well as experiments conducted to compare each of the example food products as between a control, which contained no roasted green banana flour, and test samples in which some amount of the cocoa was replaced with roasted green banana flour.

[0057] In the test samples, the green banana flour used for roasting included one or both of NuBana™ N100 (native) green banana flour and NuBana™ P500 (pre-gelatinized) green banana flour (available from International Agriculture Group, 106 LangTree Village Drive, Suite 301, Mooresville, North Carolina 28117). The green banana flour was roasted using a conventional oven on baking sheets. The sample weight of green banana flour per sheet was 300g. The baking sheet was then placed in a preheated oven at the predefined temperature and roasted for the predefined time. Roasting temperatures were accomplished at 163 °C, 177 °C, 190 °C, 205 °C and 218 °C and the roasting times varied from 15 to 60 minutes in 5-minute increments. Once the green banana flour had been roasted for the appropriate amount of time the sheet was removed from the oven and allowed to cool to room temperature by placing the tray on a wire rack. The

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roasted green banana flour was then placed in a sealed container for storage or until testing could be accomplished.

Food Product Example 1 - Preparation of non-dairy chocolate drink

5 **[0058]** A total of 60 g of cocoa powder was mixed with 20 g of granulated sugar and mixed until uniform. A coffee filter was placed in a 10 cm long stemmed glass funnel and the mixture of roasted cocoa powder and sugar was placed in the coffee filter. A total of 1 L of boiling water (100 °C) was poured through the filter and collected in a 2 L beaker. The liquid product was then placed aside to cool to room temperature (20 °C - 25 °C). The liquid product was placed in a sealed glass container until taste testing could be performed.

Food Product Example 2 - Preparation of a dairy chocolate drink

15 **[0059]** A mixture of 12g of cocoa powder and 6g of granulated table sugar were diluted with 200g of a half cream - half whole milk dairy product at 18 °C. The mixture was placed in a Waring® blender and blended on high for 70 seconds. The sample was removed from the blender cup and placed in a sealed container until taste testing was conducted. The beverages were tasted at 21 °C.

Food Product Example 3 - Preparation of a chocolate coating compound

20 **[0060]** The preparations were prepared using a mixing ball mill (Selmi Micro Ball Mill, available from Selmi, Via Statale, 151 - 12069 Santa Vittoria d'Alba) using the following procedure. The test sample compositions are shown below in Table 1.

25 **[0061]** Approximately half of the oil and all of the sugar and salt were added to the top of the ball mill. The mixture was milled and recirculated for 3-5 minutes. The temperature of the mill was not permitted to exceed 50 °C. Cooling was used as necessary to maintain the temperature below 50 °C. The lecithin, milk powder and remaining oil (holding back 2%) was added and milled until the fineness of the product was below 30 microns. The fineness was checked in a mixture of 30% mineral oil with a handheld micrometer. The content of the mill was emptied into a clean mixing bowl and the cocoa powder and roasted green banana flour was added to the mixture and mixed with a standard baking mixer at low to medium speed with a mixing attachment, scraping the sides occasionally. During mixing, heat was added to the bowl by means of a heat gun keeping the mixture between 45 °C and 50 °C. The formulation was mixed for 10-15 minutes until completely uniform.

Table 1 - Formulations for a chocolate coating compound

Ingredient*	Control	Test Sample Number				
		1	2	3	4	5
Sugar	55.45	55.45	55.45	55.45	55.45	55.45
Palm Kernel Oil	29	29	29	29	29	29
Whole Milk Powder	3	3	3	3	3	3
Sunflower Lecithin	0.5	0.5	0.5	0.5	0.5	0.5
Salt	0.05	0.05	0.05	0.05	0.05	0.05
Natural Cocoa Powder	12	10.8	10.8	9	6	6
NuBana™ N100 green banana flour roasted 40 minutes @ 205°C	-	1.2	-	3	6	3
NuBana™ P500 green banana flour roasted 15 minutes @ 205°C	-	-	1.2	-	-	-
* - all values are in parts by mass						

SENSORY ATTRIBUTE EXPERIMENTS

55 **[0062]** To establish a sensory attribute baseline, a panel tested the flavor and aroma attributes associated with cocoa powder. The panel was trained on attribute descriptors using the following definitions and references.

Attribute: Acid / Sour

[0063]

5 Definition: the taste stimulated by acids.
Reference: 0.08% citric acid in water.

Attribute: Bitter

10 **[0064]**

Definition: the taste stimulated by caffeine.
Reference: caffeine in spring water (0.1% concentration).

15 Attribute: Cacao:

[0065]

20 Definition: the characteristic aroma of roasted cocoa beans.
Reference: Ivory Coast roasted cocoa nibs (cocoa mass, lab scale).

Attribute: Roasted

25 **[0066]** Definition: the aroma associated with food items that have been browned by heat treatment.

Attribute: Alkaline

[0067]

30 Definition: the aroma associated with baking soda.
Reference: salt solution (0.7%; 1.4 grams salt to 300 grams water) as compared with a baking soda solution (5% solution, or 15 grams baking soda to 300 g water)

Attribute: Hay / Straw

35 **[0068]**

Definition: the aroma associated with sweet, sun-dried grasses.
Reference: hay, dried parsley.

40 Attribute: Earthy:

[0069]

45 Definition: the aroma associated with topsoil.
Reference: raw skins of russet potatoes.

Attribute: Moldy / Jute Bag

50 **[0070]**

Definition: the aroma reminiscent of items stored under highly humid conditions (damp basements, molds).
Reference: brie cheese.

55 Attribute: Smoky

[0071]

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Definition: the aroma associated with wood smoke odor.

Reference: liquid smoke.

5 **Experiment 1:**

[0072] The trained panel was presented with a control preparation containing cocoa powder and a test sample preparation containing NuBana™ N100 green banana flour roasted at 205 °C for the times shown below. All taste tests were conducted at room temperature. The panelists sampled preparations of the cocoa control and the roasted green banana flour prepared according to Food Product Example 1 above, wherein for the test samples NuBana™ N100 green banana flour was substituted for the cocoa powder.

Results:

15 Cocoa Control:

[0073]

20

Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
astringent	astringent	sour/bitter	sweet	astringent	bitter
bitter	bitter	Sweet	bitter	sweet	sweet roasted
sweet	sweet	Cocoa	cocoa	sour	sour
cocoa	low cocoa	tongue drying		bitter	cocoa
	sour				

25

NuBana™ N100 green banana flour roasted for 15 minutes:

30

[0074]

35

Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
bitter	bitter	bitter	astringent	bitter	astringent
sweet	sweet fruity	astringent	sweet	sour	sour
astringent		sweet	sour	sweet	
sour		sour	bitter		fruity
			astringent tongue drying		tongue

40

NuBana™ N100 green banana flour roasted for 20 minutes:

45

[0075]

50

Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
bitter	bitter	sour/bitter	astringent	astringent	bitter
sweet	astringent	sweet	sweet	sweet	sweet
astringent	sweet	cocoa	sour	sour	sour
roasted		tongue drying	bitter	bitter	roasted cocoa
sour				fruity	astringent

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NuBana™ N100 green banana flour roasted for 30 minutes:

[0076]

5	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	bitter	astringent	bitter	bitter		bitter
	sweet	burnt	burnt			sweet roasted
10	astringent	sweet	roasted			sour
	roasted					
	cooked sugar					

15 NuBana™ N100 green banana flour roasted for 40 minutes:

[0077]

20	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	bitter	bitter	harsh bitter	bitter	burnt bitter	
25	astringent	astringent	tongue burning	BURNT burnt coffee ground		
		hammy		Cross between eating used coffee grounds and cigarettes	chewing a smoked cigarette	I feel like I licked an ash tray

30 NuBana™ N100 green banana flour roasted for 50 minutes:

[0078]

35	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	astringent	bitter	bitter	bitter burnt	cannot distinguish so burnt and awful	cannot taste past the smoky ashtray
	bitter					
40	smoky					

45 **[0079]** Conclusions from Experiment 1: Shorter roasting times of the green banana flour may provide for more sour, fruity notes. As the green banana flour is roasted for longer periods of time, sour, fruity notes may be perceived less and new flavors develop, such as coffee flavor, roasted flavor, smoky and burnt. Thus, adjusting roasting times and temperatures of green banana flour in accordance with the present disclosure can result in a variety of sensory attributes.

Experiment 2:

50 **[0080]** The trained panel, including a sensory expert, was presented with a control preparation containing cocoa powder and a test sample preparation containing NuBana™ N100 green banana flour roasted at 205 °C for the times shown below. All taste tests were conducted at room temperature. The panelists sampled preparations of the cocoa control and the roasted green banana flour prepared according to Food Product Example 2 above, wherein for the test samples NuBana™ N100 green banana flour was substituted for the cocoa powder.

55 **[0081]** The panel's sensory results from Experiment 2 are summarized as follows:

Cocoa Control: dairy, sweet, sour, bitter, astringent.

NuBana™ N100 green banana flour roasted for 15 minutes: sweet, dairy, sour, bitter, astringent, fruity.

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NuBana™ N100 green banana flour roasted for 20 minutes: sweet, dairy, bitter, astringent sour, tongue drying sensation.

NuBana™ N100 green banana flour roasted for 30 minutes: dairy, sweet bitter, astringent, roasted, coffee.

NuBana™ N100 green banana flour roasted for 40 minutes: dairy, sweet, bitter, astringent, burnt, roasted, smoke.

5

[0082] Conclusions from Experiment 2: The NuBana™ N100 green banana flour roasted for 30-40 minutes at 205 °C produced roasted flavors that enhance a natural cocoa powder when blended into a dairy chocolate drink.

Experiment 3:

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[0083] All samples were prepared by the methods described in Food Product Example 3 above, wherein in the control sample cocoa powder was substituted for the roasted green banana flour. In this experiment, sensory attributes of the test sample containing roasted green banana flour were also measured on a "degree of difference" (DOD) scale, used to represent how similar the test sample was to the control sample, the scale operating from 1 to 7, 1 representing no difference and 7 representing significant difference. In this experiment the NuBana™ N100 green banana flour was roasted at 205 °C for 40 minutes and had a pH before roasting of about 4, and the green banana flour was approximately 6 months old.

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Results

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Control -12% cocoa

[0084]

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Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6	Panelist 7
sweet	dairy	sweet	sweet	sweet	creamy dairy	low sweet
dairy	sweet	dairy	Dairy	dairy	sweet	dairy
cocoa	cocoa		Cocoa	cocoa	low cocoa	
				slight plastic		

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[0085] Test Sample 1 - 10% replacement of the cocoa powder with roasted NuBana™ N100 green banana flour heated at 205 °C for 40 minutes.

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	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6	Panelist 7
	sweet	sweet	sweet	sweet	sweet	sweet	slow release of flavor
	dairy	cocoa	dairy	cocoa	dairy	creamy dairy	low sweet
	cocoa				cocoa	low cocoa	dairy
			slow flavor release	same as control	no off notes	no difference from	slight Palm oil
						control	
DOD*	2	2	3	1	3	1	3
* = Degree Of Difference							

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[0086] The sensory expert commented that Test Sample 1 was very comparable to the control formulation in that the average consumer would not likely be able to tell the difference. It had a slightly slower flavor release, less cocoa flavor and had slight palm oil notes at the end, rating it as a DOD of 4.

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[0087] Test Sample 2 - 10% replacement of the cocoa powder with roasted NuBana™ P500 (pre-gelatinized) green banana flour heated at 205 °C for 15 minutes

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	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6	Panelist 7
5							slow flavor release
	Sweet	cocoa	sweet	sweet	dairy	sweet	sweet
10	Dairy	sweet	dairy	chocolate flavor	sweet	cocoa	cocoa
	Cocoa		Cocoa		cocoa		
		slight bitter	More chocolate flavor		mocha aftertaste	bitter aftertaste	
15	DOD*	2	4	3	4 more flavor	4	
* = Degree Of Difference							

20 **[0088]** The sensory expert commented that Test Sample 2 tasted like flavor was added to the compound coating. In addition, Test Sample 2 had interesting flavor built over time, providing an attribute greater than the cocoa powder that had a roasted coffee-like attribute.

[0089] Test Sample 3 - 25% replacement of the cocoa powder with roasted NuBana™ N100 green banana flour heated at 205 °C for 40 minutes

	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	sweet	cocoa	sweet	sweet	dairy	sweet
30	cocoa	sweet	cocoa	cocoa	sweet	cocoa
				bitter	cocoa	
			Slight tongue drying	more overall initial flavor	mocha aftertaste	bitter aftertaste
35	DOD*	4	4	5	5	5
* = Degree Of Difference						

40 **[0090]** The sensory expert commented that Test Sample 3 had high end attributes like high end cocoa powders. In addition, Test Sample 3 had a longer flavor release with more intensive chocolate flavor, providing for an intensified chocolate flavor at the front end and at the back end.

[0091] Test Sample 4 - 50% replacement of the cocoa powder with roasted NuBana™ N100 green banana flour heated at 205 °C for 15 minutes

	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	sweet	cocoa	sweet	roasted	sweet	sweet
50	cocoa	chocolate	Cocoa	cocoa		cocoa
				burnt cocoa	cocoa	
				sweet		
	slow flavor release		Bitter	astringent	smoky/hammy	burnt
55	chewy texture	grainy			higher finest	granular
	DOD*	5	5	6	6	5
* = Degree of difference						

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[0092] The sensory expert commented that the larger particle size of Test Sample 4 impacted flavor release, and a different flavor attribute was introduced at the end resembling burnt caramelized sugar, the flavor ending slightly bitter. Some cocoa powders share these attributes.

[0093] **Test Sample 5** - 25% reduction in total cocoa powder.

[0094] Because more intense chocolate flavor was found at 25% cocoa replacement (from the results in Test Sample 3, above), the formulation was repeated for testing designed to identify if less total cocoa powder could produce a similar flavor intensity.

	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6
	sweet	sweet	sweet	sweet	sweet	sweet
			cocoa			
		low cocoa		low bitter	cocoa	low cocoa
	sweet		sweet mostly	sweet	sweet	
DOD*	5	4	5	5	5	5
* = Degree of difference						

[0095] The sensory expert commented that the Test Sample 5 had less cocoa flavor, and was sweeter, but had no off notes. The sample was comparable to a carob like product with a reduced overall cocoa flavor. The sensory expert expressed surprise that no off flavors were noted.

[0096] Conclusions from Experiment 3: The degree of sensory difference observed by the panelists generally increased as more cocoa powder was replaced with roasted green banana flour. However, even at relatively high levels of cocoa replacement, panelists and the sensory expert identified several sensory attributes and accompanying intensities in common with cocoa or chocolate.

Experiment 4:

[0097] All control and test samples were prepared by the methods described in Food Product Example 3 above, wherein roasted green banana flour (NuBana™ GBF P500) was used at 10, 25 and 50% replacement of the cocoa. In this experiment, sensory attributes of the test samples containing roasted green banana flour were also measured by five panelists on a "degree of difference" (DOD) scale, used to represent how similar the test sample was to the control sample, the scale operating from 1 to 7, 1 representing no difference and 7 representing significant difference. In this experiment the NuBana™ P500 green banana flour was roasted at 205 °C for 40 minutes and had a pH before roasting of about 6.57, and the green banana flour was approximately two weeks old. The results of the taste panel are shown below.

Panelist 1	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
Color	Medium Brown	Medium Brown	Medium Brown	Medium Brown
Flavor	Sweet	Sweet	Sweet	Sweet
	Cocoa	Cocoa	Mocha	Cocoa
	Dairy	Dairy	Cocoa	Coffee ground like bitter
			Dairy	Astringent
DOD		2	4	5
Comments				Slow Flavor Release, Granular mouthfeel

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Panelist 2	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
Color	Medium Brown	Medium Brown	Medium Brown	Medium Brown
Flavor	Sweet	Sweet	Sweet	Sweet
	Cocoa	Cocoa	Mocha	Mocha
	Dairy	Dairy	Cocoa	Cocoa
			Dairy	Bitter
DOD		2	4	5
Comments				Tongue drying astringent

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Panelist 3	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
Color	Medium Brown	Medium Brown	Medium Brown	Medium Brown
	Sweet	Sweet	Sweet	Sweet
	Cocoa	Cocoa	Cocoa	Cocoa
Flavor	Dairy	Dairy	Dairy	Bitter
				Astringent
				Tasted something else added vanilla mocha
DOD		2	3	5
Comments				Slow Flavor Release, Granular mouthfeel

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Panelist 4	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
Color	Medium Brown	Medium Brown	Medium Brown	Medium Brown
Flavor	Sweet	Sweet	Sweet	Sweet
	Cocoa	Cocoa	Cocoa	Mocha
	Dairy	Dairy	Dairy	Cocoa
				Bitter

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(continued)

5	Panelist 4	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
				Higher cocoa notes	Astringent
	DOD		2	3	5
10	Comments				Slow Flavor Release, Granular mouthfeel
15	Panelist 5	Control Sample	Test Sample 1, 10% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 2, 25% cocoa replacement with Roasted NuBana™ P500 green banana flour	Test Sample 3, 50% cocoa replacement with Roasted NuBana™ P500 green banana flour
	Color	Medium Brown	Medium Brown	Medium Brown	Medium Brown
20	Flavor	Sweet	Sweet	Sweet	Sweet
		Cocoa	Cocoa	Mocha/cocoa	Mocha
		Dairy	Dairy	Dairy	Cocoa
25					Bitter
					Astringent
30	DOD		1	4	5
	Comments		Same product	Added mocha to the cocoa flavor	Slow Flavor Release, Gritty. Harsh aftertaste

35 **[0098]** Conclusion from Experiment 4: roasted green banana flour with a higher pre-roasting pH gave better taste profiles without the development of the burnt and off tastes that were seen in the lower pH samples (e.g., Experiment 3). In addition, at the higher pH more complex flavor attributes were noted, resembling a higher end cocoa product.

Experiment 5

40 **[0099]** A compound coating was made using the standard ball mill procedure with the ingredients from Food Product Example 3 above, but without the cocoa or roasted green banana flour. The batch was split and cocoa powder was added at 12% usage for the control and a blend of cocoa powder and roasted NuBana™ P500 green banana flour (roasted at 205 °C for 40 minutes) was used for each of three test samples as shown in the table below. The powders
45 were added and mixed in a standard baking mixer. The compound samples were molded at 37 °C in wafer molds and put in a freezer for 5 minutes to set up before demolding. Viscosities were measured for the test sample and the control samples using a HA Brookfield™ viscometer at 20 RPM, #27 Spindle at 60 °C.

Results:

50 **[0100]**

Table 2 - viscosities of formulated chocolate coating

55	Sample	Viscosity HA Brookfield at 20 RPM, #27 Spindle at 50°C (% torque)
	Control - 12% cocoa powder	25

(continued)

Sample	Viscosity HA Brookfield at 20 RPM, #27 Spindle at 50°C (% torque)
Test Sample 6 - 10.8% cocoa powder, 1.2% roasted NuBana™ P500 green banana flour	35
Test Sample 7 - 9% cocoa powder, 3% roasted NuBana™ P500 green banana flour	38
Test Sample 8 - 6% cocoa powder, 6% roasted NuBana™ P500 green banana flour	36

[0101] Conclusions from Experiment 5: The viscosities of the compound coating sample tests were averaging 10% higher than the control sample. Though not highly significant, this margin could be attributed to the 12% cocoa butter that is intrinsically in cocoa powder or could be due to the differences in particle size distribution between the control and test samples. Furthermore, viscosity could be easily adjusted by the addition of 1-2% palm kernel oil (e.g., the held back 2% of the oil from the Food Product Example 3 method). With respect to color results, the color on all samples was medium to dark brown. There was not a noticeable difference in color between the control and test samples.

[0102] As used herein, the phrase "at least one and up to six or more" includes at least one, at least two, at least three, at least four, at least five, and at least six, and more than six.

Claims

1. A composition for a cocoa alternative comprising a flour selected from the group consisting of a gelatinized green banana flour that has been roasted, a gelatinized plantain flour that has been roasted, and combinations thereof and said composition comprising no cocoa, no cacao, and no derivative of cocoa or cacao.
2. The composition of claim 1, wherein the composition comprises roasted green banana flour made from green banana in Stage 1 and/or Stage 2 of ripeness.
3. The composition of claim 1, wherein the composition comprises roasted green banana flour made from native green banana flour.
4. A composition comprising cocoa powder and the composition according to claim 1, the cocoa powder and the gelatinized flour that has been roasted having a combined total mass, the roasted flour having a mass from 5% to 90% of the combined total mass.
5. The composition of claim 4, wherein the roasted flour has a mass from 5% to 75% of the combined total mass.
6. The composition of claim 4, wherein the roasted flour has a mass from 5% to 50% of the combined total mass.
7. The composition of claim 4, wherein the roasted flour has a mass from 5% to 25% of the combined total mass.
8. The composition of claim 4, wherein the roasted flour has a mass from 5% to 10% of the combined total mass.
9. The composition of claim 4, wherein the roasted flour comprises green banana in Stage 1 and/or Stage 2 of ripeness.
10. The composition of claim 4, wherein the roasted flour comprises roasted green banana flour made from native green banana flour and/or roasted plantain flour made from native plantain flour.
11. The composition of claim 4, further comprising one or both of: sugar not present in or derived from the roasted flour or the cocoa powder; and/or dairy.
12. The composition of claim 1 or claim 4, wherein the composition has sensory attributes comprising at least one of: a cocoa aroma and a cocoa flavor.

13. The composition of claim 1, wherein the composition comprises roasted green banana flour made from green banana having less than 1% sugar content.

5 **Patentansprüche**

1. Zusammensetzung für eine Kakaoalternative, mit einem Mehl, das ausgewählt ist aus der Gruppe, die besteht aus einem gelatinierten grünen Bananenmehl, das geröstet wurde, einem gelatinierten Kochbananenmehl, das geröstet wurde, und Kombinationen daraus, wobei die Zusammensetzung keinen Kakao, keine Kakaobohnen und kein Derivat von Kakao oder Kakaobohnen aufweist.
- 10
2. Zusammensetzung nach Anspruch 1, bei der die Zusammensetzung geröstetes grünes Bananenmehl aufweist, das aus grünen Bananen der Stufe 1 und/oder Stufe 2 einer Reife hergestellt worden ist.
- 15
3. Zusammensetzung nach Anspruch 1, bei der die Zusammensetzung geröstetes grünes Bananenmehl aufweist, das aus nativem grünem Bananenmehl hergestellt worden ist.
4. Zusammensetzung mit Kakaopulver und der Zusammensetzung nach Anspruch 1, wobei das Kakaopulver und das gelatinierte Mehl, das geröstet wurde, eine kombinierte Gesamtmasse aufweisen, wobei das geröstete Mehl eine Masse von 5% bis 90% der kombinierten Gesamtmasse hat.
- 20
5. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl eine Masse von 5% bis 75% der kombinierten Gesamtmasse hat.
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6. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl eine Masse von 5% bis 50% der kombinierten Gesamtmasse hat.
7. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl eine Masse von 5% bis 25% der kombinierten Gesamtmasse hat.
- 30
8. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl eine Masse von 5% bis 10% der kombinierten Gesamtmasse hat.
9. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl grüne Bananen der Stufe 1 und/oder Stufe 2 einer Reife aufweist.
- 35
10. Zusammensetzung nach Anspruch 4, bei der das geröstete Mehl geröstetes grünes Bananenmehl, das aus nativem grünem Bananenmehl hergestellt worden ist, und/oder geröstetes Kochbananenmehl, das aus nativem Kochbananenmehl hergestellt worden ist, aufweist.
- 40
11. Zusammensetzung nach Anspruch 4, ferner mit einem oder beiden von: Zucker, der nicht in dem gerösteten Mehl oder dem Kakaopulver vorhanden oder daraus erhalten worden ist; und/oder Milch.
12. Zusammensetzung nach Anspruch 1 oder Anspruch 4, bei der die Zusammensetzung sensorische Attribute aufweist, die mindestens aufweisen: ein Kakaoaroma oder einen Kakaogeschmack.
- 45
13. Zusammensetzung nach Anspruch 1, bei der die Zusammensetzung geröstetes grünes Bananenmehl aufweist, das aus grünen Bananen mit weniger als 1% Zuckergehalt hergestellt worden ist.

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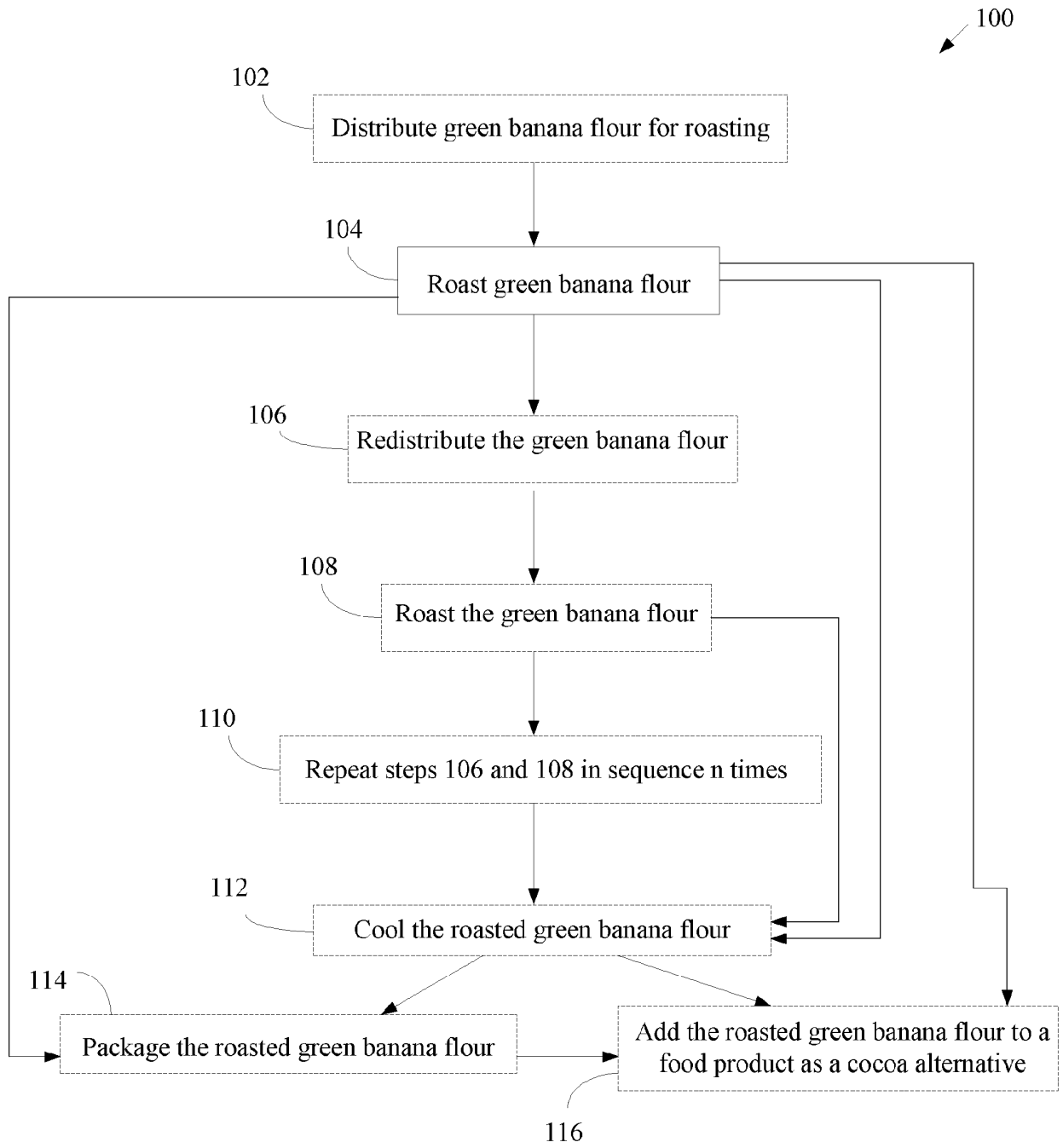
Revendications

1. Composition pour une alternative au cacao comprenant une farine sélectionnée à partir du groupe constitué par une farine de banane verte gélatinisée qui a été grillée, une farine de banane plantain gélatinisée qui a été grillée, et des combinaisons de celles-ci et ladite composition ne comprenant pas de cacao, pas de fève de cacao et pas de dérivé de cacao ou de fève de cacao.
- 55
2. Composition selon la revendication 1, dans laquelle la composition comprend de la farine de banane verte grillée

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réalisée à partir de banane verte au stade 1 et/ou au stade 2 de la maturité.

- 5
3. Composition selon la revendication 1, dans laquelle la composition comprend de la farine de banane verte grillée réalisée à partir de farine de banane verte native.
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4. Composition comprenant de la poudre de cacao et la composition selon la revendication 1, la poudre de cacao et la farine gélatinisée qui a été grillée ayant une masse totale combinée, la farine grillée ayant une masse de 5 % à 90 % de la masse totale combinée.
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5. Composition selon la revendication 4, dans laquelle la farine grillée a une masse de 5 % à 75 % de la masse totale combinée.
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6. Composition selon la revendication 4, dans laquelle la farine grillée a une masse de 5 % à 50 % de la masse totale combinée.
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7. Composition selon la revendication 4, dans laquelle la farine grillée a une masse de 5 % à 25 % de la masse totale combinée.
- 30
8. Composition selon la revendication 4, dans laquelle la farine grillée a une masse de 5 % à 10 % de la masse totale combinée.
- 35
9. Composition selon la revendication 4, dans laquelle la farine grillée comprend de la banane verte au stade 1 et/ou au stade 2 de la maturité.
- 40
10. Composition selon la revendication 4, dans laquelle la farine grillée comprend de la farine de banane verte grillée réalisée à partir de farine de banane verte native et/ou de farine de banane plantain grillée réalisée à partir de farine de banane plantain native.
- 45
11. Composition selon la revendication 4, comprenant en outre l'un ou les deux parmi : du sucre non présent dans ou dérivé de la farine grillée ou de la poudre de cacao ; et/ou un produit laitier.
- 50
12. Composition selon la revendication 1 ou la revendication 4, dans laquelle la composition a des attributs sensoriels comprenant au moins l'un parmi : un arôme de cacao et un goût de cacao.
- 55
13. Composition selon la revendication 1, dans laquelle la composition comprend de la farine de banane verte grillée réalisée à partir de banane verte ayant une teneur en sucre de moins de 1 %.



Figure

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2015366248 A1 [0009]
- US 2013156893 A1 [0009]
- US 3663718 A [0010]